



*An Chomhairle Mhúinteoireachta*  
**The Teaching Council**

**Final Report of the Review Panel to the Teaching Council following a review of a reconceptualised Initial Teacher Education Programme at the University of Limerick**

**Bachelor of Science (Education) in Physical Science with Chemistry and Physics – LM096**

**January 2015**

## Contents

<b>1. Background</b>	<b>1</b>
1.1 The Teaching Council’s Review and Accreditation Function	1
1.2 Review and Accreditation Strategy	1
1.3 National Policy Framework	1
1.4 Accreditation Criteria	2
1.5 Particular requirements for post-primary programmes	3
1.6 Programme overview	3
<b>2. The Review Process</b>	<b>4</b>
<b>3. Publication of this Report</b>	<b>7</b>
<b>4. Documentation</b>	<b>8</b>
4.1 Inputs	8
4.2 Processes	8
4.3 Outcomes	8
<b>5. Overall Findings</b>	<b>9</b>
<b>6. Commendations</b>	<b>10</b>
6.1 Conceptual Framework	10
6.1.1 Areas of Study	10
6.1.2 Subject discipline modules	10
6.1.3 Laboratory Work and Practicals	10
6.1.4 Junior Cycle Science	10
6.1.5 Literacy and Numeracy	10
6.2 Support for students	11
6.3 School Placement	11
6.4 Student Intake	11
<b>7. Recommendations</b>	<b>12</b>
7.1 Feasibility of the Extension of the Programme	12
7.2 Curriculum and Assessment Issues	12
7.3 Literacy and Numeracy	13
7.4 Core Reading Lists	13
7.5 School Placement	13

7.6	School Placement Handbook.....	13
7.7	Entry Requirements.....	14
7.8	Leadership of and collaboration in the ITE programmes.....	14
7.9	Title of the Programme.....	14
7.10	An elective module in Irish (GA 4006 - An Ghaeilge Ghairmiúil).....	14
<b>8.</b>	<b>Stipulations .....</b>	<b>15</b>
8.1	Need to Strengthen the Specific Study of Physics and to meet the required 60 ECTS credits in Physics.....	15
8.2	Chemical Nanotechnology.....	15
8.3	Subject Pedagogies.....	15
8.4	Staff-Student Ratio .....	15
8.5	Design of the programme – need for a student handbook.....	15
8.6	Foundation Studies.....	16
<b>9.</b>	<b>National Issues .....</b>	<b>17</b>
9.1	Curriculum Design and Assessment .....	17
9.2	Duration of Concurrent ITE Programmes.....	17
9.3	Comparability of ITE Programmes.....	17
9.4	Supply Needs of Irish-medium schools .....	18
	<b>Appendix 1 Review Panel Membership .....</b>	<b>19</b>
	<b>Appendix 2 Visit Schedule.....</b>	<b>20</b>
	<b>Appendix 3 Teaching Council Registration: Curricular Subject Requirements .....</b>	<b>21</b>
	Chemistry.....	21
	Physics .....	23
	Physics and Chemistry.....	24

## **1. Background**

### **1.1 The Teaching Council's Review and Accreditation Function**

The Teaching Council is the statutory body charged with setting the standards for entry to the teaching profession and ensuring that these standards are upheld.

In accordance with Section 38 of the Teaching Council Act, 2001, the Council shall:

- (a) review and accredit the programmes of teacher education and training provided by institutions of higher education and training in the State,
- (b) review the standards of education and training appropriate to a person entering a programme of teacher education and training, and
- (c) review the standards of knowledge, skill and competence required for the practice of teaching,

and shall advise the Minister and, as it considers appropriate, the institutions concerned.

The Teaching Council's role in relation to the review and accreditation of programmes of Initial Teacher Education (ITE) is distinct from the academic accreditation which programmes also undergo. Academic accreditation is based on the suitability of a programme for the award of a degree/diploma, whereas professional accreditation for any profession is a judgement as to whether a programme prepares one for entry into that profession.

The review and accreditation of programmes of ITE by the Teaching Council provides an opportunity for Higher Education Institutions (HEIs) to demonstrate that they offer quality programmes of teacher education. It is expected that the graduates of such programmes will achieve programme aims and learning outcomes which are aligned with the values, professional dispositions, and the standards of teaching, knowledge, skill and competence that are central to the practice of teaching.

### **1.2 Review and Accreditation Strategy**

In order to guide its review of programmes, the Teaching Council has published *Initial Teacher Education: Strategy for the Review and Accreditation of Programmes* (hereinafter referred to as the Council's review strategy). That document sets out the process by which programmes are reviewed.

### **1.3 National Policy Framework**

In carrying out reviews, the Council is mindful of its *Policy on the Continuum of Teacher Education* which sets out its vision for teacher education at all stages of the continuum – ITE, Induction, and Continuing Professional Development. Published in 2011, the policy highlights the evolving and dynamic context for teaching and the increasingly complex role of teachers in Ireland today. The policy states that "...the time is now right for a thorough and fresh look at teacher education to ensure that tomorrow's teachers are competent to meet the challenges that they face and are life-long learners, continually adapting over the

course of their careers to enable them to support their students' learning." It further states that innovation, integration and improvement should underpin all stages of the continuum.

In parallel with the development by the Council of its *Policy on the Continuum of Teacher Education*, the Minister for Education and Skills initiated a national consultation process on the theme of improving literacy and numeracy. This culminated in 2011 with the publication of *Literacy and Numeracy for Learning and Life* as the national strategy to improve literacy and numeracy standards among children and young people in the education system. The strategy emphasised teachers' professional development and proposed that the duration of initial teacher education (ITE) programmes should be extended and that programme content should be reconceptualised.

#### **1.4 Accreditation Criteria**

The Teaching Council, having established an Advisory Group on Initial Teacher Education, developed criteria to be observed and guidelines to be followed by providers in reconceptualising programmes of initial teacher education at primary and post-primary levels. They were approved by the Council and published in June 2011 as *Initial Teacher Education: Criteria and Guidelines for Programme Providers* (hereinafter referred to as the Council's criteria). These relate to a range of areas, including programme design, areas of study, the duration of programmes, the numbers and qualifications of staff, facilities and resources. As such, they form the bridge between the Council's policy and the development and implementation of reconceptualised programmes. Significantly, the criteria:

- prescribe those areas of study which will be mandatory in programmes, including numeracy and literacy, behaviour management, parents in education, ICT and inclusive education
- set out for the first time the expected learning outcomes for graduates of all ITE programmes
- propose raising the minimum requirements for persons entering programmes of ITE at primary level and a literacy and numeracy admissions test for mature entrants
- require a 15:1 student-staff ratio
- call for the development of new and innovative school placement models, involving active collaboration between HEIs and schools, and an enhanced role for the teaching profession in the provision of structured support for student teachers
- require that student teachers should spend at least 25% of the programme on school placement, and that such placements should be in a minimum of two schools
- require increased emphasis on research, portfolio work and other strategic priorities.

While recognising the inter-related nature of all aspects of programmes of teacher education, the criteria and guidelines are categorised under Inputs, Processes and Outcomes. All three dimensions have an important bearing on the quality of teacher education. The required Inputs and Outcomes are clearly elaborated in the document, while the Processes are less prescriptive to allow HEIs the freedom to develop the processes which best suit their individual situations.

Providers of existing programmes have been asked to reconceptualise their programmes in line with the revised criteria and to submit them for accreditation.

### 1.5 Particular requirements for post-primary programmes

In November 2011, the Council published *Teaching Council Requirements for Entry onto a Programme of Initial Teacher Education*, which set out the Council's revised subject criteria in draft form. Following a wide ranging consultation process involving all the major education stakeholders, a final set of proposals was developed. These were approved by Council in December 2012, and the Minister for Education and Skills has conveyed his agreement with the Council's views in this area. They have guided providers of post-primary concurrent programmes in determining the subject content coverage which is appropriate. They also guide providers of post-primary consecutive programmes in determining suitability of entrants and which curricular subjects entrants can ultimately be registered to teach, and in matching students appropriately to methodology modules.

### 1.6 Programme overview

From the early 1970s, Thomond College of Education in Limerick provided concurrent post-primary teacher education programmes in physical education, woodwork, metalwork and rural and general sciences. Thomond College was integrated into the University of Limerick in 1991 and responsibility for the teacher education programmes was transferred to the university at that time. In the early 1990s, a concurrent science education degree in Biological Science with Physics or Chemistry (now LM092) was introduced. In the late 1990s – recognising the demand for specialist teachers in Physics and Chemistry, and using the Biological Science programme as a template – the Bachelor of Science (Education) in Physical Science (with specialisation in Chemistry and Physics) – now LM096 - was developed.

In 2009/2010 all undergraduate programmes at the university, including the programme under review, were restructured to ensure compatibility with the European Credit Transfer and Accumulation System (ECTS).

The Bachelor of Science (Education) in Physical Science with Chemistry and Physics programme (LM 096) is one of a number of concurrent initial teacher education programmes provided by the University of Limerick. Other concurrent programmes include:

- LM090 BSc Physical Education with English, Gaeilge, Geography or Mathematics
- LM092 Bachelor of Science (Education) in Biology with Chemistry or Physics or Agricultural Science
- LM094 Bachelor of Technology (Education) Materials and Architectural Technology
- LM095 Bachelor of Technology (Education) Materials and Engineering Technology

There are more than 1,000 undergraduate students enrolled on these five concurrent ITE programmes. Although each programme is led and co-ordinated by staff in the relevant faculties and discipline, they all share the same education and school placement modules.

This report relates to the review of LM096 - the Bachelor of Science (Education) in Physical Science with Chemistry and Physics - (hereinafter referred to as "the programme") at the University of Limerick (hereinafter referred to as "the university").

On successful completion of LM096, graduates are entitled to be registered with the Teaching Council to teach the following subjects to Leaving Certificate level:

- Physics
- Chemistry

- Physics and Chemistry

Graduates are also entitled to teach the Junior Cycle Curricular Subject Science.

For enrolment in the programme, applicants are required to hold the established Leaving Certificate (or an approved equivalent) with at least grade C3 in two higher level subjects and grade D3 in four ordinary or higher level subjects (including Mathematics and English and another language). In addition, applicants are required to hold at least the following in the Leaving Certificate (or an approved equivalent):-

- Grade C3 in Ordinary Level Irish
- Grade B3 in Ordinary level Mathematics (grade D3 in higher level Mathematics also suffices)
- Grade D3 at higher level (or grade C3 or above at ordinary level) in one of the following subjects: Applied Mathematics, Physics, Chemistry, Physics with Chemistry, Engineering, Technical Drawing, Construction Studies, Agricultural Science, Biology.

Typically students entering the programme have grades that exceed the minimum entry requirements due to the high competition for the programme. Entry to the programme is primarily through the CAO system. The minimum points required for acceptance into this programme in 2013/2014 were 420. Garda vetting is also required.

The following are the numbers of students accepted onto the programme in the last four years.

<b>Bachelor of Science (Education) in Physical Science with Chemistry &amp; Physics</b>	
<b>Year</b>	<b>Number of Students</b>
2010 - 2011	10
2011 - 2012	4
2012 – 2013	8
2013 - 2014	17

Up to 15% of places on this programme each year are available to mature students who apply directly to the university. In 2011/12 and 2012/13 one mature student was accepted each year onto the programme and in 2013/14, two mature students were accepted.

## **2. *The Review Process***

The review of the programme took place between March 2013 and January 2015, in accordance with the Council’s review strategy. The process was formally initiated when the Review Panel (hereinafter referred to as ‘the panel’) was appointed by the Teaching Council’s Director, with Professor Áine Hyland as Chairperson.<sup>1</sup> To assist and support the work of the panel, Risteard Ó Broin was appointed as Rapporteur. His functions included liaison with the university, maintaining records of meetings, and drafting and finalising the panel’s report in conjunction with the panel Chairperson. The panel was supported by external subject advisers in the subjects Physics and Chemistry. Valuable support was also provided by the Director and staff of the Teaching Council.

---

<sup>1</sup> Details of the Review Panel membership are included in [Appendix I](#)

Documentation relating to the application was initially submitted to the Teaching Council by the University of Limerick in March 2013. Following consideration of the documentation and discussions with UL staff during visits in March and July 2013, the panel became aware that the programme had not been reconceptualised in accordance with the Teaching Council's revised guidelines. UL agreed to revise the submission to ensure that it was in accordance with the guidelines and a revised submission was made in June 2014. The documentation was furnished in hard copy to the members of the panel on 17 June 2014. Panel members were asked to review the documentation and to submit their initial observations, comments or concerns to the rapporteur. In the course of reviewing the documentation, the panel maintained contact on a systematic basis both by e-mail and phone. The Teaching Council also forwarded the documentation to the relevant external subject advisers. These external subject advisers provided their reports to the panel by the end of August 2014.

The panel met on Tuesday 23 September 2014 to discuss the LM096 programme along with the two other ITE programmes at UL which were also being reviewed by the panel.

Following that meeting, meetings were requested with the university management, programme leaders and subject co-ordinators of LM096. These meetings were held on Thursday 16 October 2014. At the meetings, further information was provided regarding issues of concern for the panel:

**a) Staff/student ratio**

The Teaching Council's document *Initial Teacher Education: Criteria and Guidelines for Programme Providers* (August 2011) states that "(t)he ratio of students to academic staff should be a maximum of 15:1". The Teaching Council report in 2010 on UL's B.Sc. (Education) in Physics and Chemistry programme (LM096) noted that the staff/student ratio in DEPS was in excess of 1:40 – well in excess of the average staff/student ratio in the university at that time. That report strongly recommended that the staff/student ratio should be reviewed and should be at a minimum, on a par with the average ratio across UL. In subsequent correspondence with the Teaching Council, UL "recognised the comparatively high staff/student ratio in DEPS as related to teacher education provision". It assured the Teaching Council that "The University Executive is working on a revised Resource Allocation Model which can serve to address the disparities in resources between Departments".

In view of the ongoing correspondence in 2010 and 2011 about staff/student ratio, the panel was concerned to read in the documentation relating to LM096 submitted in 2014, that the ratio in DEPS appeared to be still in the region of 1:40. The panel met with the Registrar, Professor Paul McCutcheon and the Assistant Registrar, Dr. Pat Phelan, on 16 October 2014 to discuss this and other overarching issues relating to the provision of the ITE concurrent programmes at UL. At the meeting the Registrar informed the panel that steps have been taken systematically by UL to increase the number of staff and improve the staff/student ratio in DEPS since 2010. He explained the formula by which staff/student ratios are computed and compared throughout the university. He stated that the ratio in DEPS has improved from 1:40 in 2010 to 1:25 in the 2012/13. In 2010, there were 15 full-time staff in DEPS there are now 24 full-time staff, including three at professorial level. Please note that stipulation 8.4 of this report addresses this issue.

**b) Programme duration and design**

Discussion also took place regarding the panel's concerns about how UL could meet the Teaching Council ECTS credit requirements in a four-year programme, normally totalling 240 ECTS credits. The panel noted that the reconceptualised LM096 programme totals 276 ECTS credits, i.e., 36 ECTS credits more than the normal four year programme, and that the student workload far exceeds what would normally be expected. Some of the staff involved in the programme recognised this difficulty and they too expressed concern about what they termed "subject overspill". The panel noted that some other providers, which had previously offered a two-subject concurrent ITE

programme in four years, have recognised that they can no longer do so within a four-year time-frame and have extended their programme to five years to meet the Teaching Council requirements.

**c) Allocation of ECTS credits to programme modules**

In UL, modules are listed as either 6 ECTS credits or 3 ECTS credits. The majority of modules require 20 hours of contact and independent study for each ECTS credit. This would appear to be less than that generally required by other institutions, where the norm is 25 hours per ECTS credit.

The panel also drew attention to the fact that the contact time (lectures, laboratories, and tutorials) as listed in the module descriptors, seems to vary considerably between modules. For example CH4303 (Analytical Chemistry 1A), which is worth 6 ECTS credits is described as having 72 contact hours whereas CH4013 (Organic Chemistry 2) has 36 contact hours for the same number of ECTS credits. (See Section 9.3.)

**d) Concerns about meeting the ECTS requirements for Physics**

The Teaching Council subject criteria state that in the case of applicants who wish to teach the curricular subject Physics, the “specific study of Physics” must comprise at least 60 ECTS credits in the qualifying degree.

In the case of LM096, it was noted that while modules accounting for 48 ECTS credits were coded as Physics modules (with a PH code), two modules which were claimed by UL as Physics modules had MS (Maths Science) and CH (Chemistry) codes i.e. MS 4613 (Vector Analysis) and CH4017 (Chemical Nanotechnology). It was also noted that only seven of the Physics modules (comprising 42 ECTS credits) appear to offer practical work. Moreover, the area of semi-conductors as relevant to Leaving Cert Physics, is lacking.

In the case of MS4613, the panel was advised that while Vector Analysis is used to solve some problems in Leaving Cert Higher Physics it is not regarded as a significant component of Leaving Cert. Physics. Students must be able to distinguish between vectors and scalars and give examples. They must also be able to recognise the vector nature of forces, electric and magnetic fields. Higher Level students are required to find the result of two perpendicular vectors and to be able to obtain expressions and carry out calculations for components of a vector in perpendicular directions. Vectors form part of the section on Motion and are mentioned in the section on Equilibrium. They are also mentioned under Electric and Magnetic fields. While Vector Analysis is important mathematically, the panel does not accept that it can be described as “the specific study of Physics”.

**e) Other Areas**

Details about the Foundation and Professional Studies component and school placement had already been provided to the panel during its review of two other ITE programmes (LM094 and LM095). As these components are common to all ITE programmes at the university, it was not necessary to seek further information about them. However, some further detail about how literacy and numeracy are addressed in all the ITE programmes was sought.

The panel also received further clarification about how modules (both Education and subject-specific) are assessed.

### **3. *Publication of this Report***

The Teaching Council routinely makes information available to the public in relation to its functions and activities and, in line with that practice, this report will be available on the Council's website, [www.teachingcouncil.ie](http://www.teachingcouncil.ie).

## **4. Documentation**

Detailed documentation relating to LM096, consisting of the completed Teaching Council pro-forma and five volumes of appendices totalling over 500 pages, was submitted in June 2014 by the University of Limerick in hard copy and electronic format. There were some apparent contradictions in the submitted documentation which provided a significant challenge for the panel to comprehend and analyse.

The panel noted that the template used for programme approval in UL does not include information on module assessment. As a result, only limited information was available in the completed pro forma relating to individual module assessment. Some module descriptors also lacked a statement of learning outcomes for that module. These points were highlighted by a number of external subject advisers who found it difficult to provide a comprehensive review of modules in the absence of such information.

Key areas of focus in the documentation were:

### **4.1 Inputs**

- Conceptual Framework
- The Programme
- Programme Aims
- Programme Design
- Areas of Study
- Teaching, Learning and Assessment Strategies
- School Placement
- The Duration and Nature of the Programme
- Student Intake
- Staffing
- Facilities
- Student Support and Guidance Systems
- Communication and Decision-Making Structures
- Financial Resources

### **4.2 Processes**

- Teaching, Learning and Assessment Approaches
- Engagement of Student Teachers with the Programme
- Engagement of Student Teachers with Staff and with other Student Teachers
- Progression within the Programme
- Personal and Social Development
- Development of Professional Attitudes, Values and Dispositions
- Lifelong Learning
- Reflective Processes

### **4.3 Outcomes**

- Knowledge-Breadth/Knowledge-Kind

- Know-How & Skill-Range/Know-How & Skill-Selectivity
- Competence-Context/Competence-Role
- Competence-Learning to Learn
- Competence-Insight

## 5. *Overall Findings*

Having regard to the Pro Forma submission from the university, together with the supplementary material provided, the written advice of the external subject advisers and the meetings with management and staff of the university, the panel adjudges that, **subject to the stipulations in Section 8 below**, the programme LM096 Bachelor of Science (Education) in Physical Science with Chemistry and Physics satisfies the criteria set down by the Teaching Council in its Criteria and Guidelines and in its curricular subject requirements. Accordingly, it recommends to the Teaching Council that the programme be granted accreditation, subject to these stipulations.

The commendations in Section 6 of this report relate to areas of particular strength of the programme which the panel has identified. With regard to the recommendations in Section 7, the panel submits that the Teaching Council should require UL to set out, within twelve months of receiving the final review report, its proposals for implementing the recommendations. It further recommends that the Teaching Council should prioritise those areas to be accorded particular attention when the programme falls due for re-accreditation.

The stipulations in Section 8 of the report relate to areas which the panel believes to be of such strategic importance to the programme that accreditation should be subject to those stipulations being met. Therefore, the panel recommends that the Teaching Council should require the University of Limerick to set out and submit to the Teaching Council, within two months of receiving the final review report, its proposals for implementing the stipulations.

In light of the considerable additional workload required of staff and students to deliver a programme of up to 276 ECTS credits in four years, the panel proposes that an **interim review** be carried out after the first two years of the programme (i.e. in 2017/8) with a particular focus on the student workload and the implementation of the stipulations of this report. Subject to meeting the stipulations and the findings of the aforementioned interim report, the panel recommends that accreditation should be for a period of five years after which a full review of the programme should be carried out (i.e. during the academic year 2019/20).

In the case of the national issues raised in Section 9, the panel recommends that the Council engage in dialogue on those issues at national level.

## 6. *Commendations*

Having regard to:

1. the Pro Forma documentation which was submitted
2. the supplementary material received
3. advice received from the curricular subject specialist who supported the review process and
4. information gleaned during the visit to the University of Limerick and subsequent engagement with programme staff,

the panel has noted a number of particular strengths of the programme, as follows:

### 6.1 *Conceptual Framework*

The conceptual framework underpinning the Initial Teacher Education programmes at the University of Limerick indicates that the programmes are based on sound educational philosophies and values. The case for concurrency is strongly advanced, although the argument that early specialisation may not always be in the best interest of the profession is not mentioned. The vision presented of the 'professional teacher in Irish schools' as one who is characterised by critical thinking and inquiry, whose work is rooted in research and evidence, is appropriate.

#### 6.1.1 *Areas of Study*

It is commendable that there are several references to reflective practice in both the foundation studies and school placement components of the programme. For example, students are encouraged to make key decisions about their teaching practice in the module *School as an Institution*. It is suggested that the six-step School Self-Evaluation (SSE) process should further inform this reflective practice so that graduates will be fully prepared to engage in the required SSE process when they begin working in schools.

#### 6.1.2 *Subject discipline modules*

The content of the subject discipline modules is of a high standard and comparable with modules in similar third-level institutions

#### 6.1.3 *Laboratory Work and Practicals*

Lectures in core modules are accompanied by Laboratory Practical work and tutorials. In most instances, practical work is included throughout the degree programme.

#### 6.1.4 *Junior Cycle Science*

The programme includes the necessary additional ECTS credits in biology that are required to teach junior cycle science.

#### 6.1.5 *Literacy and Numeracy*

Some of the learning outcomes indicate that student teachers will identify opportunities to develop literacy and numeracy, plan for literacy and numeracy in teaching and learning, and discuss strategies for the effective integration of literacy and numeracy within their subjects. It is commendable that these particular learning outcomes feature in both the disciplinary modules and the foundation studies modules. Also positive, is the fact that student teachers are required to demonstrate skills in the teaching of literacy and numeracy within their subject specialism during their periods on school placement. However, not all aspects of the Department of Education and Skills Literacy and Numeracy Strategy are evident in LM096. (See Recommendation 7.3).

## **6.2 Support for students**

The panel commends UL's comprehensive support and guidance system for students. It particularly commends the support systems for students who may require additional help with mathematics and science.

## **6.3 School Placement**

The principles, procedures and supports for school placement are systematically outlined and discussed both in the main submission from the university and in the specific school placement documentation received by the panel. The procedures to develop positive relationships with schools are particularly commendable.

The Teaching Council has determined that 60 ECTS credits over the four years of undergraduate ITE programmes should be allocated to school placement and that requirement is being met. The school placement component includes in-school work, preparation for school placement and provision for students to reflect critically on their practice.

The emphasis on partnership with schools and how a partnership approach will be implemented and developed is commendable. Likewise the panel was impressed by the provision of continuing professional development opportunities for school placement tutors.

## **6.4 Student Intake**

While a majority of the students enter the programme directly from the Leaving Certificate, the panel commends the university for its policy on the recognition of prior learning and on its policy to increase access for students who come from disadvantaged and minority backgrounds.

## 7. Recommendations

Having regard to:

1. the Pro Forma documentation which was submitted
2. the supplementary material which was received by the panel
3. advice received from the curricular subjects specialist who supported the review process and
4. information gleaned during the visit to the University of Limerick and subsequent engagement with programme staff,

the panel has noted a number of areas of the programme which it believes should be developed. They are as follows:

### 7.1 Feasibility of the Extension of the Programme

The panel acknowledges the pressures placed upon programme managers by the increase in education components in four-year post-primary concurrent programmes. In order to address the increased education requirements while also seeking to meet the Teaching Council subject criteria, UL has increased the number of ECTS credits from 240 to 276 in the case of LM096. This increase will result in very intensive workloads for both staff and students over the four years of the programme and the panel is concerned that this might impede efforts aimed at developing the students as reflective practitioners.

The number of credits is outside the recommended workloads for eight-semester, four-year, undergraduate programmes in the current guidelines for implementation of ECTS within the Bologna framework of the European Higher Education Area. The panel therefore strongly recommends that the programme should **either** be extended to five years, with a possible redefinition of some of the final year modules to Level 9 on the National Framework of Qualifications **or** if the programme is to remain a four-year programme, it should be re-designed so that students will meet the Teaching Council's registration criteria for only **one** of the subjects – Physics or Chemistry (and Junior Cycle science). Models for both structures for concurrent ITE post-primary programmes currently exist in Ireland.

### 7.2 Curriculum and Assessment Issues

The panel recognises that the programme includes a module entitled Curriculum Studies (Appendix C: Foundation Studies module samples) which focuses on philosophical and sociological aspects of curriculum and national curriculum policy.

In view of the introduction of short courses, including those to be developed at school level, and the introduction of school-based assessment at junior cycle, the panel recommends that the programme should explicitly address the theory and practice of curriculum and syllabus design.

The theory and practice of assessment - formative, summative and diagnostic – should also be included and made explicit in relevant Foundation Studies and Subject Pedagogies components of the programme.

National strategies and compliance areas for schools should be given greater emphasis throughout the four years of the programme. The programme should include explicit training in junior and senior cycle key skills and the Statements of Learning in the new Junior Cycle framework. The inclusion of these issues in several modules would support integration and give emphasis to their national importance.

### 7.3 Literacy and Numeracy

The debate currently being promoted by the UL programme leaders regarding the national directives to enhance 'literacy and numeracy' across all school subjects is important. This debate should involve students and should bear in mind that the National Strategy states that ITE providers must:

- Ensure that development opportunities in literacy and numeracy feature as a priority
- Develop student teachers' ability to apply current knowledge in the use of current assessment for formative, diagnostic and summative purposes in literacy and numeracy
- Develop student teachers' ability to apply current knowledge in digital literacy and how ICT may be used to support and enrich learning in literacy and numeracy, as appropriate to their subject specialism
- Ensure that all teachers are required to demonstrate satisfactory skills in the teaching of literacy and numeracy as relevant within their subject specialism during the school placement component of their ITE
- Ensure that all teachers complete mandatory units in the development of literacy and numeracy across the curriculum.

### 7.4 Core Reading Lists

The core and extended reading lists in many of the Foundation Studies modules and in some of the subject discipline modules should be more up-to-date with current developments in education and with aspects of subject-specific education. Contemporary papers/podcasts/articles on developments in education and their impact on teaching, learning and assessment should be included, as should articles on school-based assessment (including assessment for learning), school self-evaluation, and literacy and numeracy.

### 7.5 School Placement

The overall allocation of ECTS credits for school placement is in compliance with the Teaching Council guidelines. Currently, students spend some time on observation in senior classes of primary schools, which is acceptable, but it would be preferable if the time spent teaching in post-primary classes were increased, particularly for final-year students. While the panel acknowledges that the minimum 100 hours of direct teaching experience will be met and that indeed a significant number of additional hours are allocated above minimum, it recommends that the university works purposefully towards achieving the Teaching Council's desired target of 200 to 250 hours for all programmes.

### 7.6 School Placement Handbook

Currently, the university provides a generic School Placement Handbook for all ITE students (on concurrent and consecutive ITE programmes) which gives details about many aspects of the school placement experience and answers some of the students' frequently asked questions. It is recommended that the handbook be re-configured to have separate handbooks for the concurrent and consecutive programmes.

The Teaching Council ITE guidelines require that school placement should *provide opportunities for student teachers to plan for and use a wide range of strategies in teaching, learning and assessment*. In the module descriptors the term "appropriate" range of teaching strategies is used. In addition, the School Placement Handbook should make it clear that the student teacher will move gradually from a strongly supported experience in the classroom to teaching independently.

### **7.7 Entry Requirements**

Applicants for LM096 are not required to have studied any science subject to Leaving Certificate level, although the panel was assured that in practice virtually all students will have done so. The panel recommends that UL reconsider the entry requirements for this programme so that applicants will be required to have taken at least one of the LM096 subjects (Physics **or** Chemistry **or** Physics & Chemistry) to Leaving Cert level.

### **7.8 Leadership of and collaboration in the ITE programmes**

The panel is of the view that given the number of students enrolled in initial teacher education programmes in UL and the stated importance of teacher education programmes in the university's portfolio of programmes, the newly appointed professors of teacher education and STEM education should be actively involved in the leadership and delivery of the initial teacher education programmes. While the structures seem to allow for considerable interaction between all staff engaged in ITE, it was apparent that the necessary level of collaboration may not have occurred prior to the preparation of Pro-Forma submissions for accreditation on this occasion. There needs to be a greater collaboration among programme coordinators both in the design and delivery of the programmes.

### **7.9 Title of the Programme**

The panel has been advised that the title of the programme, BSc (Education) in Physical Science **WITH** Chemistry and Physics, may give the impression that the subjects are not recognised for teaching to Leaving Certificate level. The panel recommends that the title be reconsidered, in consultation with Teaching Council staff, with a view to deleting or replacing the word "with".

### **7.10 An elective module in Irish (GA 4006 - An Ghaeilge Ghairmiúil)**

The panel notes that an elective module (GA 4006 – An Ghaeilge Ghairmiúil) is available for students who wish to study Irish during their degree course. The documentation for programmes LM094 and 095 makes reference to this elective module. During the visit on 16 October, the panel was informed that it is open to students on any of the concurrent ITE programme to take this module (subject to timetabling) and that some students who would like to teach in a Gaelscoil or Gaelcholáiste find the module particularly helpful. The panel recommends that student documentation for all programmes includes reference to this elective module.

## **8. Stipulations**

Having regard to:

1. the Pro Forma documentation which was submitted
2. the supplementary material which was submitted
3. advice received from the curricular subject specialist who supported the review process and
4. information gleaned during the visit to the university and subsequent engagement with programme staff,

the panel has noted the following areas of the programme which it considers must be addressed to the satisfaction of the Council as a matter of priority and, at the latest, within two months of the final report being received.

### **8.1 Need to Strengthen the Specific Study of Physics and to meet the required 60 ECTS credits in Physics**

The panel is advised that LM096, as currently designed, does not meet the necessary minimum 60 ECTS credits in Physics. Even allowing 6 ECTS credits for the Chemical Nanotechnology module, the total ECTS credits comes to 54, or six credits short of the Teaching Council minimum. This shortfall must be addressed if accreditation is to be maintained. Given the issues raised about MS4613 (Vector Analysis) and the lack of the study of semi-conductors, the Physics element of the programme needs to be strengthened to include and make explicit the study of semi-conductors, and to incorporate more practical work.

### **8.2 Chemical Nanotechnology**

The Chemical Nanotechnology module – CH4017 - (syllabus and learning outcomes) needs to be reviewed and revised in order to strengthen the references to Physics, so that the module is an effective cross-disciplinary module that merges both Physics and Chemistry.

### **8.3 Subject Pedagogies**

The subject pedagogies modules should make explicit reference to investigative and inquiry-based approaches to learning junior cycle science. In addition, the modules should emphasise the importance of developing students' self-directed learning and independent thought for senior cycle, in keeping with the aims and principles of Leaving Certificate, LCA and Transition Year programmes.

These modules should include explicit training in junior and senior cycle key skills and the Statements of Learning in the new Junior Cycle framework. Their inclusion in several modules would support integration and give emphasis to their national importance.

### **8.4 Staff-Student Ratio**

In view of the conflicting information in relation to the staff/student ratio of DEPS, the panel stipulates that a statement be provided by the university, showing the current staff/student ratio, with an explanation of how this ratio is calculated by the university and how it compares with other departments in UL. The statement should indicate how and when the university plans to meet the Teaching Council requirements in relation to staff/student ratio.

### **8.5 Design of the programme – need for a student handbook**

The initial documentation submitted for this programme was difficult for the panel to decipher as module titles and codes were not always consistent. Moreover, some module descriptors were incomplete. These inconsistencies, which may result from different practices in course and module design in different faculties

and departments of the university, initially led the panel to question the extent of integration and co-ordination of the programme. Where a programme is designed and delivered by academic staff from different disciplines across the university, it is particularly important that the programme documentation is clear and consistent and that the overall rationale and coherence of the programme is made explicit to students.

The panel therefore stipulates that a concise, user-friendly student handbook (of about 30 pages maximum) should be prepared for this programme by the programme co-ordinator, and made available to the Teaching Council, setting out clearly:

- The programme ethos and rationale (this should include the material showing the progression and development of subject content and pedagogy over the four years of the programme as explained to the panel by the programme co-ordinator at the meeting on 16 October)
- The programme aims
- The programme learning outcomes (education and subject outcomes)
- Explanation of the ECTS including definition of a Credit Unit
- Sequence of modules

The handbook should include, at least in relation to one semester, a short description of each module indicating:

- The module rationale
- The module aim
- The module learning outcomes and an indication of how the module learning outcomes contribute to the overall programme learning outcomes.
- Teaching and Learning Activities (e.g. lectures, workshops, laboratory work, course work, independent learning, tutor-supported online learning, assessment) indicating the ECTS and the approximate number of hours spent on each activity.
- Indicative syllabus
- Module assessment
- Module reading list (indicating separately core readings - usually no more than two or three - and additional readings which might include online journals, websites, podcasts etc.)
- Module staff

## **8.6**    *Foundation Studies*

The Foundation Studies modules addressing the historical background to Irish education should be reviewed in order to strengthen this aspect of the programme. The panel noted that in some of the sample examination papers provided, the History of Education examination question appears to be optional. As History of Education is a compulsory area of study in the Teaching Council Criteria and Guidelines, its assessment should also be compulsory.

## **9. National Issues**

Having regard to:

1. the Pro Forma documentation which was submitted
2. the supplementary material which was submitted
3. advice received from the external subject advisers who supported the review process and
4. information gleaned during the visit to university and subsequent engagement with programme staff,

the panel has noted the following issues which it believes merit further attention by the Teaching Council and/or other national stakeholders.

### **9.1 Curriculum Design and Assessment**

In the context of the proposed changes to the Junior Certificate programme, and of international best practice, all teacher education programmes should be required to make visible their approach to curriculum design and assessment. In practical terms, this requires a greater emphasis on the processes by which curriculum is designed, the theory and practice of diagnostic, formative and summative assessment and on the uses and limitations of testing. Arising from this, the Teaching Council's criteria and associated Pro Forma and Guidelines should be kept under review, having regard to the evolving context for the junior cycle and other areas of the curriculum at national level.

### **9.2 Duration of Concurrent ITE Programmes**

The panel is aware of the heavy workload imposed on students in concurrent initial teacher education programmes where two subject disciplines are studied to degree level (level 8) within a timeframe of four years (240 ECTS credits or more). The Teaching Council criteria now require 120 ECTS credits to be applied to the education elements of the programme leaving a considerably reduced number of credits for the subject disciplines. This is particularly onerous for students who have not previously studied the subjects in question and are encountering the subject disciplines *ab initio* in a university environment. The panel is also aware that in the case of some of the subject discipline modules in UL, the amount of contact hours and ECTS credits allocated, are less than are available for similar programmes in other higher education institutions.

The panel recommends that the Teaching Council reconsider the duration and credit allocation of concurrent ITE programmes for post-primary teachers where more than one subject discipline is being studied.

### **9.3 Comparability of ITE Programmes**

The panel notes that modules in the University of Limerick are computed on the basis of six ECTS credits or multiples thereof, whereas in other HEIs, the normal unit of computation for modules is five ECTS credits. Moreover, the student contact time (e.g. lectures, laboratories, tutorials) varies considerably for modules with the same ECTS credit value (see Section 2(c) of this report. This raises issues of comparability and consistency across ITE programmes in different HEIs. The panel recommends that the Council discuss the implications of this with ITE providers and other relevant bodies at national level.

#### **9.4 Supply Needs of Irish-medium schools**

In line with the “20 year Strategy for the Irish Language 2010 – 2030” the teacher supply needs of Irish medium schools, and the teaching of Irish, require the special attention of the Council.

## ***Appendix 1 Review Panel Membership***

### **Independent Review Panel Chair**

Professor Áine Hyland is Emeritus Professor of Education and former Vice-President of University College Cork. She is a member of the European Universities Association Institutional Evaluation team and has been involved in reviews of universities in Italy,

Turkey, North Cyprus, Bosnia-Herzegovina, Slovakia, Portugal and Romania. She is author of A Review of the Structure of Teacher Education Provision in Ireland, a Background Paper published in June 2012, and Transition from Second to Third Level, published in September 2011.

### **Teacher Education Expert**

Professor Seán Farren is a former member of the School of Education at the University of Ulster, where he is currently a Visiting Professor. He is also a former Member of the Northern Ireland Assembly and former Minister of Higher and Further Education in the NI Executive. In recent years he has been involved in developing research partnerships with universities in East Africa through the Irish-Africa Research Capacity Building project. He has published widely on curriculum development and the history of Irish education.

### **Teaching Council Member**

Patrick Mc Vicar was nominated to the Teaching Council by the post-primary school management organisations of ACCS, JMB and ETBI. He was previously Principal of Pobalscoil Chloich Cheannfhaola, Falcarragh, Co. Donegal. He is a former member of the Association of Community & Comprehensive Schools (ACCS) Executive Committee, where he chaired the Education sub-committee. He served on a number of NCCA committees including Course Committees for Technical Graphics, Design & Communication Graphics and the Board of Studies for Technological Subjects. At Teaching Council, he is a member of the Education, Registration and Disciplinary sub-committees and serves on the Post-primary Applications Panel.

### **Inspector from the Department of Education and Skills**

Carmel Donoghue is senior Post-Primary Science Inspector at the Department of Education and Skills. She has a variety of experience in research, curriculum, teaching and inspection. Her work involves a range of evaluation models of teaching and learning, as well as whole-school evaluations, including management and leadership.

### **Rapporteur**

Risteard Ó Broin is a former member of the Inspectorate of the Department of Education and Skills. Initially he worked as a District Inspector and later at Divisional level. In addition to conducting whole-school evaluations, he contributed to policy formulation and implementation in a variety of settings throughout the education system including the area of initial teacher education. Prior to being appointed an inspector, he taught at primary level in a number of schools and also served as a principal teacher of a large school for a period of seven years.

## Appendix 2 Visit Schedule

### SCHEDULE OF MEETINGS THURSDAY 16 OCTOBER 2014

#### 9.30-11.00 Meeting with Senior Management

- Prof. Paul McCutcheon (Vice President and Registrar)
- Prof. Edmond Magner (Dean of Faculty of Science and Engineering)
- Dr. Pat Phelan (Associate Registrar)

11.00 – 11.30 Tea/ Coffee

#### 11.30 – 12.00 LM094 and LM095 programmes

- Dr. Oliver McGarr (Head of Education & Professional Studies )
- Dr Seamus Gordan (Head of DMT Department)
- Dr. Niall Seery (Course Director LM095)
- Dr. Donal Canty (Course Director LM094)

#### 12.00 – 13.00 LM090 programme

- Dr. Oliver McGarr (Head of Education & Professional Studies)
- Prof. Brigitte Moody (LM090 Course Director)
- Dr. Deborah Tannehill (PE specialist)
- Dr. Michael Griffin (English specialist)
- Dr. Catherine Dalton (Geography specialist- MIC)
- Dr. Tadgh O hlfearnain (Gaeilge specialist)
- Dr. Olivia Fitzmaurice (Maths specialist)

13.00 – 14.00 Lunch

#### 14.00- 15.00 LM092 and LM096 programmes

- Dr. Oliver McGarr (Head of Education & Professional Studies )
- Dr. Damien Thompson (Physics specialist and LM096 Course Director)
- Dr. Sarah Hudson (Chemistry specialist)
- Dr. Thomas Harrington (Biology specialist and former LM092 CD)
- Dr. Ken Byrne (Agricultural Science specialist)
- Dr. Audrey O'Grady (Biology specialist and LM092 CD)

## Appendix 3 Teaching Council Registration: Curricular Subject Requirements

(Post-primary) Effective for registration on or after 1 January 2017

### Chemistry

*In order to meet the registration requirements set down in the Teaching Council [Registration] Regulations in respect of the curricular subject of Chemistry, an applicant must meet **all** of the following criteria:*

- Applicants must hold a degree-level qualification, with Chemistry studied up to and including third-year level or higher (or modular equivalent).
  - The qualifying degree must be equivalent to at least Level 8 on the National Framework of Qualifications (NFQ) and with a minimum pass<sup>2</sup> result in all examinations pertinent to the subject of Chemistry.
  - The qualifying degree must carry at least 180 ECTS (European Credit Transfer System) credits (or equivalent) with the specific study of Chemistry modules comprising at least 60 ECTS credits (or equivalent) and with not less than 10 ECTS credits (or equivalent) studied at third-year level or higher (or modular equivalent).
- The study of Chemistry during the degree must show that the holder has acquired sufficient knowledge, skills and understanding to teach the Chemistry syllabus<sup>3</sup> to the highest level in post-primary education (see [www.curriculumonline.ie](http://www.curriculumonline.ie)). To meet this requirement the degree must include the study of all of the following essential areas to a minimum of 40 ECTS credits (or equivalent):

#### **Essential areas of study**

- Organic Chemistry<sup>4</sup>
- Inorganic Chemistry<sup>5</sup>
- Physical Chemistry<sup>6</sup>
- Analytical Chemistry<sup>7</sup>.

The remaining 20 ECTS credits (or equivalent) may be in any of the essential areas above or may be drawn from the following optional areas:

#### **Optional areas of study**

- Environmental Chemistry<sup>8</sup>

---

<sup>2</sup> which includes pass by compensation.

<sup>3</sup> as approved by the Minister for Education & Skills, and published by the National Council for Curriculum and Assessment (NCCA).

<sup>4</sup> This may include modules in the areas of Structure and Reactivity of Organic Compounds, Functional Group Interconversions, Stereochemistry, Organic Reaction Mechanisms, Aromatic Chemistry, Organic Polymers, or Organic Synthesis.

<sup>5</sup> This may include modules in the areas of Main Group Chemistry, Transition Metal Chemistry, Organometallic Chemistry, or Structure and Bonding.

<sup>6</sup> This may include modules in the areas of Energetics and Kinetics, Thermodynamics, Chemical Equilibria, Quantum Mechanics or Electrochemistry.

<sup>7</sup> This section may be studied as "stand alone" modules in Analytical Chemistry or may be integrated into modules of Inorganic Chemistry, Organic Chemistry or Physical Chemistry. The study of Analytical Chemistry may include Instrumentation in Chemical Analysis and Spectrometry (atomic absorption, ultraviolet, infrared, NMR, mass spectrometry) GC, HPLC, Electrochemical Methods, or Solvent Extraction.

<sup>8</sup> This may include modules in the areas of Water Chemistry, Atmospheric Chemistry, or Pollutants in the Environment.

- (f) Materials Chemistry<sup>9</sup>
- (g) Pharmaceutical Chemistry/Biopharmaceutical Chemistry<sup>10</sup>
- (h) Industrial Chemistry<sup>11</sup>.

3. Laboratory practical work in chemistry must have been completed throughout the degree programme.
4. Applicants must also have completed a programme of post-primary initial teacher education (age range 12-18 years) carrying a minimum of 120 ECTS credits (or equivalent)<sup>12</sup>. The programme should include a methodology module(s) on the teaching of a Science-based subject with a minimum of 5 ECTS credits (or equivalent)<sup>13</sup>.

#### **Science (Junior Certificate)**

An applicant who meets the registration criteria for **Chemistry** will also meet the requirements for the Junior Cycle curricular subject **Science** if he/she has studied a minimum of 10 ECTS credits (or equivalent) in Biology and a minimum of 10 ECTS credits (or equivalent) in Physics.

---

<sup>9</sup> This may include modules in the areas of Solid State Chemistry, Crystallography, or Band Structure.

<sup>10</sup> This may include modules in the areas of Drug Design, Structure-Activity Relationships, or Synthetic Methods.

<sup>11</sup> This may include modules in the areas of Batch Process, Continuous Process, Industrial Safety, or Industrial Case Studies.

<sup>12</sup> Applicants who have commenced a programme of initial teacher education prior to 01/09/2014 carrying less than 120 ECTS credits may be exempted from this requirement at the Council's discretion.

<sup>13</sup> Applicants who have completed a specialist concurrent degree in Chemistry must meet all of the requirements as detailed above. This course should be equivalent to a minimum of 240 ECTS credits.

## Physics

In order to meet the registration requirements set down in the Teaching Council [Registration] Regulations in respect of the curricular subject of Physics, an applicant must meet **all** of the following criteria:

1. (a) Applicants must hold a degree-level qualification, with Physics studied up to and including third-year level or higher (or modular equivalent).
  - (b) The qualifying degree must be equivalent to at least Level 8 on the National Framework of Qualifications (NFQ) and with a minimum pass<sup>14</sup> result in all examinations pertinent to the subject of Physics.
  - (c) The qualifying degree must carry at least 180 ECTS (European Credit Transfer System) credits (or equivalent) with the specific study of Physics comprising at least 60 ECTS credits (or equivalent) and with not less than 10 ECTS credits (or equivalent) studied at third-year level or higher (or modular equivalent).
2. The study of Physics during the degree must show that the holder has acquired sufficient knowledge, skills and understanding to teach the Physics syllabus<sup>15</sup> to the highest level in post-primary education (see [www.curriculumonline.ie](http://www.curriculumonline.ie)). To meet this requirement the degree must include the study of at least eight of the following areas:
    - (a) Classical Mechanics
    - (b) Quantum Mechanics
    - (c) Properties of Matter
    - (d) Oscillations, Waves, Acoustics
    - (e) Thermodynamics
    - (f) Light
    - (g) Electromagnetism, Electromagnetic Waves
    - (h) Electronics
    - (i) Condensed Matter
    - (j) Relativity
    - (k) Atomic, Nuclear and Particle Physics
    - (l) Topic in Advanced or Applied Physics
3. Experimental/practical work must be completed throughout the degree course.
  4. Applicants must also have completed a programme of post-primary initial teacher education (age range 12-18 years) carrying a minimum of 120 ECTS credits (or equivalent)<sup>16</sup>. The programme should include a module(s) on the teaching of a Science-based subject carrying a minimum of 5 ECTS credits (or equivalent)<sup>17</sup>.

### **Science (Junior Certificate)**

An applicant who meets the registration criteria for **Physics** will also be deemed to have acquired the competency to teach the Junior Cycle curricular subject **Science** if he/she has studied a minimum of 10 ECTS credits (or equivalent) in Chemistry and a minimum of 10 ECTS credits (or equivalent) in Biology.

<sup>14</sup> which includes pass by compensation.

<sup>15</sup> as approved by the Minister for Education & Skills, and published by the National Council for Curriculum and Assessment (NCCA).

<sup>16</sup> Applicants who have commenced a programme of initial teacher education prior to 01/09/2014 carrying less than 120 ECTS credits may be exempted from this requirement at the Council's discretion.

<sup>17</sup> Applicants who have completed a specialist concurrent degree in Physics must meet all of the requirements as detailed above. This course should be equivalent to a minimum of 240 ECTS credits.

## Physics and Chemistry

In order to meet the registration requirements set down in the Teaching Council [Registration] Regulations 2009 (Regulation 4) in respect of the curricular subject of Physics and Chemistry, an applicant must meet **all** of the following criteria.

**Applicants should note that meeting the registration requirements for the curricular subject of Physics and Chemistry (combined syllabus) does not automatically imply that registration requirements for the individual subjects of Physics or Chemistry have been met.**

1.
  - (a) Applicants must hold a degree level qualification, with Physics and Chemistry studied in the degree with the study of at least one of the subjects up to and including third year level or higher.
  - (b) The qualifying degree must be equivalent to at least Level 8 on the National Framework of Qualifications (NFQ) and with a minimum pass<sup>1</sup> result in all examinations pertinent to the subjects of Physics and Chemistry.
  - (c) The qualifying degree must carry at least 180 ECTS (European Credit Transfer System) credits (or equivalent) with the specific study of Physics and Chemistry comprising at least 60 ECTS credits (or equivalent) with at least 15 ECTS (or equivalent) in Physics and 15 ECTS (or equivalent) in Chemistry and with not less than 10 ECTS credits (or equivalent) studied at third year level or higher (or modular equivalent).
2. The study of Physics and Chemistry during the degree must show that the holder has acquired sufficient knowledge, skills and understanding to teach the Physics and Chemistry syllabus<sup>2</sup> to the highest level in post-primary education (see [www.curriculumonline.ie](http://www.curriculumonline.ie)). To meet this requirement the degree must include the study of at least four of the following Physics areas:
  - (a) Classical Mechanics
  - (b) Quantum Mechanics
  - (c) Oscillations, Waves, Acoustics
  - (d) Thermodynamics
  - (e) Light
  - (f) Electromagnetism, Electromagnetic Waves
  - (g) Atomic, Nuclear and Particle PhysicsThe degree must also include the study of at least two of the following Chemistry areas:
  - (a) Organic Chemistry
  - (b) Inorganic Chemistry
  - (c) Physical Chemistry
3. Experimental/practical work must be completed throughout the degree course.
4. Applicants must also have completed a programme of post-primary initial teacher education (age range 12-18 years) carrying a minimum of 120 ECTS credits (or equivalent)<sup>3</sup>. The programme should include a module(s) on the teaching of a Science based subject carrying a minimum of 5 ECTS credits (or equivalent)<sup>4</sup>.

---

<sup>1</sup> Which includes pass by compensation

<sup>2</sup> as approved by the Minister for Education & Skills, and published by the National Council for Curriculum and Assessment (NCCA)

<sup>3</sup> Applicants who have commenced a programme of initial teacher education prior to 1/01/2014 carrying less than 120 ECTS credits may be exempted from this requirement at the Council's discretion

<sup>4</sup> Applicants who have completed a specialist concurrent degree in Physics must meet all of the requirements as

### **Science (Junior Certificate)**

An applicant who meets the registration criteria for **Physics and Chemistry** will also meet the requirements for the Junior Cycle curricular subject **Science** if he/she studied a minimum of 10 ECTS credits (or equivalent) in Biology.

